ATTACHMENT 4A:
INDOOR DUST SAMPLING PROTOCOLS

INDOOR DUST SAMPLING PROTOCOLS

1. OVERVIEW

This document provides protocols for the collection of surface dust and air samples for subsequent analysis for the presence of contaminants of potential concern (COPCs), and the identification of sources within the sampled spaces that may contribute to the observed results. Protocols will be provided for sampling of 1) residential units, 2) common areas, 3) identification of indoor lead sources, and 4) identification of indoor asbestos and MMVF sources. Within residential units and common areas in buildings, dust will be collected from two areas; 1) "accessible", and 2) "infrequently accessed"areas

"Accessible" areas are defined as areas in which exposures readily occur including "soft" surfaces such as rugs and upholstered furniture, and "hard" surfaces such as walls, and table tops.

"Infrequently accessed" areas are defined as areas in which dust may accumulate but which cause exposure infrequently such as on top of bookshelves, on top of refrigerators, chests of drawers or other tall objects.

"Common" areas are defined as areas not under the control of any one tenant. i.e., lobbies, corridors, stairways, washrooms in lobby, laundry or recreational rooms, etc.

Air samples will also be collected in the accessible portions of residential units and common areas.

2. STRATEGY FOR SAMPLING UNITS

2.1. Selecting Units

A sampling unit is defined as a reasonably small, confined and well defined area that will vary from building to building and within buildings. The procedure for selecting units follows these steps:

i. Determine Eligibility as detailed in the Sampling Plan
Testing and cleanup work, as necessary, will be offered in the area below Canal Street and west of Allen-Pike Street. There will be a period of 2 months during which residents and building owners in this area may make requests to participate in this program. Employees and employers will not be eligible for this program.

Individual Residents: Individuals who own or rent their apartment who are concerned that dust from the collapse of the WTC may still be present in their residence may request assistance from EPA.

Buildings: Owners, boards of cooperatives or condominiums and managers of residential or commercial buildings can request to have their building's common

areas and HVAC system evaluated and cleaned, as necessary. After receiving the request, and upon signature of appropriate access agreements, common areas and HVAC systems will be evaluated as described below.

Employees and Employers: The Occupational Safety and Health Act of 1970 gives employees the right to file complaints about workplace safety and health hazards. If employees or their representatives believe that their working conditions are unsafe or unhealthful as a result of contamination by WTC dust they may follow the procedures outlined at http://www.osha.gov/as/opa/worker/complain.html to file a complaint. Alternatively, employees, authorized representatives of employees, or employers can request an evaluation by the National Institute of Occupational Safety and Health of possible health hazards associated with a job or workplace. The procedure to be followed is outlined at http://www.cdc.gov/niosh/hhe/Request.html.

EPA will implement this effort utilizing the $7 million in FEMA funding that has been earmarked for this program. In order to ensure that these funds are expended in a manner that will maximize the reduction in potential exposure to remaining dust: EPA will not test spaces that were not cleaned after the collapse of the WTC, are currently uninhabited, and slated for demolition, and EPA will not test in buildings constructed or reconstructed after May 2002 (when the cleanup effort at the WTC site was completed). Requests within the area of confirmed contamination and in closest proximity to the WTC will be given priority for testing.

ii. Obtain signed access agreements (agreement forms to be provided by EPA)

iii. Identify and characterize the building and units eligible using EPA provided checklists or survey guidance (for lead and asbestos) for buildings, units and HVAC systems.

Characterizations will include:

Descriptive information
Owner or other responsible individual or party for the building and units;
Number and location of floors sampled per bldg
Number of rooms sampled per floor
Square footage of floors and of space sampled per floor
Location and orientation (directly facing or the side most directly facing, facing an area perpendicular, facing in the direction opposite) to WTC of space sampled
Cleaning and renovation history since WTC collapse
Type, number, age of windows in spaces sampled
Number of window or wall HVAC units
Cleaning and replacement history of window or wall HVAC units since WTC collapse

Visible WTC dust reported present in unit
Reported cleaning frequency and date of last cleaning prior to sampling
Carpet present
Carpet cleaned or replaced since WTC collapse

Attribution Information
Location and amount of friable asbestos material present in sampled space
Location and area of MMVF present, i.e. ceiling tiles, pipe insulation, spray on fireproofing
Location and amount of chalking/peeling paint present
(Note: detailed procedures for investigating the above three items are described later in this document.)
Current use of space
Significant particulate or combustion sources with sampling area, e.g. fireplace, stove, occupant who smokes
Significant particulate or combustion sources within or adjacent to the building, e.g. above fast food restaurant, adjacent to emergency diesel generator exhaust

Central HVAC Design Information
Location of air inlets
Location of filters or other air cleaning devices in system
Number and Location of HVAC return ducts in sampled space
Central HVAC cleaning and replacement history since WTC collapse
Whether or not the unit is served by an HVAC

The intent behind this procedure is to ensure that only eligible buildings or units are sampled; that sufficient information is gathered to characterize the buildings or units sampled, to determine whether sources of COPC exist within or adjacent to the areas sampled and to allow examination of potential relationships between results and the characteristics of the units and common areas sampled.

2.2. Selecting Locations within Units to Sample

Sampling teams will enter sampling units with the intent of collecting individual microvac and wipe samples from no less than 6 and no more than 20 sample locations, for "accessible" and "infrequently accessed" COPC analysis; scaled to floor area as follows: <1000sf = 3 samples, >1000 and <5000sf =5samples, >5000sf =7 samples, >10000sf = 10 samples (for each type of location).

Target areas for "accessible" hard and soft surface sampling in residential units include, if present and in priority order:

i) area or wall-to-wall carpeting. Carpet locations include, in an order of most to least preferred location (on the basis of exposure considerations): 1) in the main entrance used for access and egress from the building; 2) carpet in the secondary, less heavily used entrance to the house; 3) carpet in the center of the most frequently used play area for

children under the age of six; and 4) carpet in an acknowledged or evident route of high traffic flow (i.e., stairs, hallway, etc.);

ii) the kitchen tiled floor, hardwood floors, or hard floors of other surfaces types (laminate, e.g.);

iii) draperies/curtains in the living room, which is the primary location if draperies/curtains are to be sampled, and then draperies/curtains in other rooms of the unit;

iv) the wall at hand level for a resident child, or adult where no children occupy the unit;

v) the wall adjacent to the head of the bed in a child's bedroom, or in the adult bedroom where no children occupy the unit;

vi) kitchen counter tops;

vii) table tops for tables located in the dining room, living room, family room, or bedroom, and the top of bureaus in bedrooms;

viii) upholstered furniture.

ix) window sills

Target areas for accessible hard and soft surface sampling in common areas include, if present:

i) area or wall-to-wall carpeting, and draperies/curtains;

ii) tiled, hardwood, or other hard-surfaced floors;

iii) desk or table tops;

iv) the wall in the most actively used location in the area;

v) upholstered furniture;

vi) window sills

Target areas for infrequently accessed hard and soft surfaces in residential units include, if present:

i) the trough of a window;

ii) the top of door jambs, vent ducts, or hot water pipes;

iii) on top of large appliances such as refrigerators, or upright freezers;

iv) on top, beneath , or behind large objects of furniture such as bookcases, tall chests or beds canopies;

Target areas for infrequently accessed hard and soft surfaces in common areas include, if present:

i) the trough of a window;

ii) the top of door jambs, vent ducts, or hot water pipes;

iii) on top, beneath or behind large objects such as built in file cabinets or bookcases;

The following samples will be collected at each of the above sample locations: 1 microvac, 1 PAH wipe, 1 Metal Wipe.

Sampling teams will enter into the unit or common area and, at that time, carry out a sampling plan for the unit or common area. They will have in their possession sampling equipment including equipment for air, wipe and microvac sampling. The air sampling equipment is to be used to determine the concentration of asbestos and MMVF fibers in air. The wipe and microvac sampling equipment are specifically for the collection of COPC samples. Procedures for sampling a chosen location with this equipment are provided below. The building checklist will be completed prior to entry into the unit or common area and provided to the project manager. If not completed during the initial site visit the unit checklist will be completed before leaving the sampling area and provided to the project manager.

"Accessible", and "Infrequently Accessed" Sampling

The candidate sample locations and number of samples to be collected are described above. The square footage of the unit or common area is to be measured and the number of sampling locations calculated. Sampling locations are always to be selected in the order presented in the lists above starting at the top and working down. For example in a residential unit of under 1000 square ft, locations i, ii, and iii would always be sampled if they existed. In a unit of over 10,000 square feet, all 9 locations would be selected (if present) and then a 10^{th} sample would be collected from the first item on the list (the carpets). The same process will be followed whenever the number of sample locations required exceeds the number of types of locations available. Whenever the number of locations required exceeds the number of types of locations required the selection process will start over again from the top of the list until enough samples have been taken.

There should be equal numbers of metal, PAH and microvac samples collected in the unit. Where possible, air samples will be collected at locations proximate to the accessible metal, PAH and microvac samples. The general strategy for sampling is to emphasize locations where

exposure occurs - accessible areas in the locations of most use within the unit; and locations infrequently accessed areas that may serve as a reservoir for recontamination of accessible areas. The strategy for selecting locations for wipe/microvac sampling should consider:

i) good spatial coverage of the entire unit - samples should be distributed throughout and not focus on a limited area of the unit; this is why the entire list should be cycled through

ii) if present both hard and soft surfaces should be sampled, with roughly an equal number of samples in both types of locations. In the instance where soft surfaces are not present or almost not present, such as a location with all hardwood floors and no upholstered furniture, it is appropriate to forego soft surfaces.

iii) a PAH and metal wipe as well as a microvac should be sought for each type of location chosen. Where possible all three samples should be adjacent and the air sample collected proximate to them in the accessible areas.

2.3. Selecting Locations in Common Areas for Sampling

In order to characterize common areas wipe, microvac and ambient air samples will be collected. The following principles will apply to this sampling. Sampling teams will sample the following locations on every floor of buildings volunteered and selected for evaluation. As with unit sampling if more samples are required than there are types of target areas the target area list should be cycled thru from top to bottom until the required number of samples are collected. An effort should be made to collect successive sets of samples at increasing distances from the entrances for access and egress from the building (such as street door, elevator or stairwell exits). Thus if the area is large enough to require 5 samples the first 3 would be collected at the floor, wall and ceiling of the entrance to the area. The second set would be collected approximately half way into the space and would be floor and wall samples.

Accessible Area Sampling

Target areas include: 1) the floor or carpet at entrance used for access and egress from the building, 2 a wall at same location, and 3 the ceiling at same location. One microvac, one PAH wipe, and one metal wipe will be collected at each of these three locations

Infrequently accessible area Sampling

1 sample each behind, below or above 2 or more infrequently moved objects in common areas; 2) sample above top door jamb ledge

Air Sampling

Residential unit and building common areas also are part of this effort. For small spaces, less than 160 square feet, 3 samples will be collected. For large spaces greater than 160 square feet

and less than 25,000 square feet 5 samples will be collected. For spaces greater than 25,000 square feet, 1 sample will be collected for each 5,000 square feet. The air samples within a contiguous area will be collected simultaneously. Sampling equipment shall be placed away from obstructions. The procedures used to locate the air samplers are described more fully in Attachment 4 d.

3. PROCEDURES FOR SAMPLING

3.1. Wipe Sampling

The following equipment is required for surface wipe sampling: 1) painters' tape (used for holding down sampling templates and marking sample locations), 2) glass sample jars, 3) sample labels, 4) sampling template (reusable plastic templates both in square and "L" shapes), 5) measuring tape, 6) moist wipes ("Ghost Wipes" for lead and "sterile gauze wetted with a solvent" for PAHs), 7) field notebook, 8) indelible ink marker, 9) ink pens, 10) refuse bags, and 11) disposable powderless, vinyl gloves

The following steps are required for template assisted wipe sampling for hard surfaces:

i) pull on a pair of clean, disposable powderless vinyl gloves;

ii) carefully place an appropriately sized clean template (10 cm x 10cm) on the surface in a manner that minimizes disruption of settled dust. Tape the outer edge of the template to the surface using painters' masking tape to prevent it from moving during sample collection;

iii) discard gloves used to mark the area in a refuse bag and pull on a new pair of clean, powderless, plastic gloves;

iv) remove appropriate wipe from its packaging, keeping it out of contact with surrounding surfaces;

v) first wiping, side-to-side: Hold one edge of the wipe between the thumb and forefinger, draping the wipe over the fingers of a gloved hand. Hold fingers together, hand flat, and wipe the selected surface area, starting at either corner furthest away from the operator, if a horizontal surface is being sampled, or either upper corner, if a vertical surface is being sampled, using a slow side to side sweeping motion. During wiping, apply pressure to the fingertips. At the end of the first pass from one side to the other, turn the leading edge of the wipe (the portion of the wipe touching the surface) 180 degrees, pulling the wipe path slightly down or closer to the operator make a second side-to-side pass in the reverse direction, slightly overlapping the first pass. Continue to cover the sampling area within the template, using the slightly overlapping side-to-side passes with the 180 degree turns at each edge until the close/bottom corner of the template is

reached. Carefully lift the leading dust line into the wipe using a slight rolling motion of the hand to capture the dust inside the wipe. Fold the wipe in half with the sample side folded inside the fold;

vi) second wiping, top-to-bottom: using a clean side of the wipe, perform a second wiping over the sampling area within the template starting from a far/top corner in the same manner used for the first wiping, except use a top-to-bottom sweeping of the surface. When the close/bottom corner of the template is reached, carefully lift the leading dust line into the wipe using a slight rolling motion of the hand to capture the dust inside the wipe. Fold the wipe in half (again) with the sample from this second wiping folded inside the fold;

viii) third wiping, clean corners: using a clean side of the wipe, perform a third wiping around the perimeter of the sampling area within the template to pick up any dust remaining in the corners. Start from one edge of the template and use the same wiping technique as described above. When the perimeter has been wiped and the starting location reached, carefully life the leading dust line into the wipe. Fold the wipe in half one more time with the sample from this third wiping folded inside the fold;

ix) insert the folded wipe into a sample jar. Label the jar with a DCS sample label detailing sample location and property sampled;

x) make a sketch of the sample location in a field notebook and record an accurate measure of the inner dimensions to the nearest one millimeter of the sampling template for sample area verification purposes;

xi) clean the template using no fewer than two clean wipes making sure to clean the front, back, and inner surfaces. Discard all used gloves and dirty wipes.

The following steps are required for wipe sampling of windowsills:

i) pull on a pair of clean, powderless, disposable vinyl gloves;

ii) mark an outline of the sampling location using masking tape. Care should be taken to minimize any disruption of dust at the sampling location. For areas that are dirty or contain high dust levels, new tape may have to be applied more than once to get adhesion to the surface. Discard any soiled tape in a refuse bag;

iii) discard any gloves used to mark the area in a refuse bag and pull on a new pair of clean, powderless, disposable vinyl gloves;

iv) remove an appropriate wipe from its packaging making sure it does not touch any surfaces;

v) first wiping, one direction, side-to-side: Hold one edge of the wipe between the thumb and forefinger, draping the wipe over the fingers of a gloved hand. Hold fingers together, hand flat, and wipe the selected surface area, starting at either corner furthest away from the operator, using a slow side-to-side (right to left or left to right) sweeping motion. During wiping, apply pressure to the finger tips. At the end of the first pass, carefully lift the leading dust into the wipe using a slight rolling motion of the hand to capture the dust inside the wipe. Fold the wipe in half with the sample side folded inside the fold;

vi) second wiping, one direction, side-to-side: Using a clean side of the wipe, repeat the previous step using a wiping motion in the reverse direction;

vii) third wiping, clean corners: using a clean side of the wipe, perform a third wiping around the perimeter of the sampling area to collect any dust remaining in the corners. Start from the middle of one edge of the area and use the same wiping technique as described above. When the perimeter as been wiped and the starting location reached, carefully lift the leading dust line into the wipe using a slight rolling motion of the hand to capture the dust inside the wipe. Fold the wipe in half one more time with the sample from this third wiping folded inside the fold;

viii) insert the folded wipe into a sample jar. Label the jar with a DCS sample label detailing sample location and property sampled;

ix) make a sketch of the sample location in a field notebook. Make an accurate measurement of the inner dimensions of the sampled area to the nearest one millimetre and record this in field notes. Remove all tape carefully and discard in the refuse bag;

xi) discard all gloves in a the refuse bag.

3.2. Microvac Sampling

Microvac sampling is required for sampling of asbestos and MMVF in residential and non-residential units. .

The following equipment is required for microvac sampling: 1) painters' tape (used for holding down sampling templates and marking sample locations), 2) sample bags, 3) sample labels, 4) sampling template (90 cm^2 reusable plastic templates both in square and "L" shapes), 5) measuring tape, 6) sampling pump, 7) flow calibration devices, 8) sampling equipment cleaning agents (e.g., 1,1-difluoroethane compressed gas cleaner, detergents, deionized water, etc.), 9) sampling cassettes, 10) field notebook, 11) indelible ink marker, 12) ink pens, 13) refuse bags, and 14) disposable powderless, vinyl gloves

The following steps are required for microvac sampling:

i) pull on a pair of clean, powderless, disposable vinyl gloves;

ii) mark the area to be sampled using one of the following two procedures:

> Template Assisted Marking: carefully place a clan template on the surface in a manner that minimizes disturbance of settled dust. When sampling curtains use a stiff piece of cardboard or a table to drape curtains over to assist in taking sample. When sampling upholstered furniture use Manual Marking. Tape the outside edge of the template to prevent it from moving during sample collection.
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> Manual Marking of Sample Area: mark an outline of the sampling location using painters' tape. Care should be taken to minimize any disruption of dust within the sampling location. For areas that are dirty or contain high dust levels, new tape may have to be applied more than once to get adhesion to the surface. Discard any soiled tape in a refuse bag;

iii) discard any gloves used to mark the area in a trash bag and pull on a new pair of clean, powderless disposal vinyl gloves;

iv) if not pre-labelled from pre-field processing, label a filter cassette with an ink marker. Remove the inlet and outlet plugs and place them into a labelled resealable plastic bag. Attach the outlet to the airsampling pump with a piece of flexible tubing 40 cm in length. Attach the collection nozzle to the inlet side of the filter cassette using a short section of new tubing (less than 1.25 cm). Always use a new section of tubing for the inlet side of the filter cassette;

v) first vacuuming: one direction, side-to-side: With the air-sampling pump on, vacuum the selected sampling surface area, starting at either of the corners furthest from the operator, using a slow died to side sweeping motion while holding the collection nozzle at an angle of approximately 45° to the sampling surface. Avoid pressing down hard on the sampling surface during sample collection. Move the nozzle at a rate of approximately 5-10 cm per second. At the end of the first pass from one side to the other, carefully lift the collection nozzle and repeat the one side to the vacuuming sweep in the same direction as the first, using a slightly closer overlapping pass. Care must be taken to avoid overloading of the filter cassette. Repeat the procedure until the entire sampling area has been covered using the one-direction, side-to-side sweeping motions;

vi) overloading will result in decreased air flow and a reduction in sample efficiency and increased sampling bias toward smaller, less dense particles. A drop of airflow of more than 10% is an indicator of overloading. If overloading of samples becomes evident, reduce the sampling area to prevent filter overloading or use multiple cassettes for collection within the same sample area;

vii) second vacuuming: one direction, top-to-bottom: with the air-sampling pump on, vacuum the selected sampling surface area, starting at a far corner, using a slow top-to-bottom sweeping motion in the same manner as described above. Repeat the procedure until the entire sampling area has been covered using the one-direction, top-to-bottom sweeping motions;

viii) third vacuuming: one direction, side-to-side: With the air-sampling pump on, vacuuming the selected sampling surface area, starting at a far corner, using the slow, one-direction, side-to-side sweeping motion described above. Repeat the procedure until the entire sampling area has been covered using the one-direction, side-to-side sweeping motions;

ix) remove the filter cassette from the inlet and outlet tubing sections, replace the cassette plugs, and place the sample into a labeled, resealable plastic bag. Using a tape measure, measure the dimensions of the sampled area to within 1 mm, record this measurement in a field book. Label the sample bag with an identifier unique to the sample and sketch the sample location in a field book along with the unique sample identifier;

x) discard used gloves and tape in a refuse bag;

xi) reassess calibration of the sampler and record current calibration level. Determine percent difference between the original and current vacuum calibration.

The microvac will need to be cleaned between each sample. The following steps are required for microvac cleaning:

i) the 15 mm long tygon connector tubing between cassette and collection nozzle should be changed and discarded;

ii) following removal of the 15 mm long tygon tubing connector from the stainless steel nozzle, flush any collected dust from the nozzle with compressed gas such as 1,1_difluoroethane compressed gas cleaner or equivalent;

iii) following completion of sampling in each residence, clean stainless steel nozzles, as follows:

- wash nozzles using laboratory grade phosphate free detergent such as Sparkleen at a ratio of 5 ml detergent:1 R water;

- thoroughly rinse using municipally treated tap water;

- complete a final rinse with deionized water;

- air dry to remove all moisture from the interior surface of the nozzle.

iv) remove and discard the connector tubing between the cassette and personal pump when the tubing becomes damaged or restricts flow.

3.3 HVAC Evaluation
Detailed evaluation procedures are attached.

3.4 Air Sampling
Detailed sampling procedures are attached.
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3.5 Asbestos Survey
If an exceedance of a benchmark is documented in a unit a survey to determine the source of the problem will be conducted. The procedures to be followed are those described in:
40CFR 763.85 Inspections and Reinspections
40CFR 763.86 Sampling
40CFR 763.87 Analysis
40CFR 763.88 Assessment

3.6 Lead Survey
If an exceedance of a benchmark is documented in a unit, a survey to determine the source of the problem will be conducted. If an exceedance of a benchmark is documented for the building as a whole, a survey to determine the source of the problem will be conducted. The procedures to be followed are those described in: U.S. Department of Housing and Urban Development; Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing; Chapter 7: Lead-Based Paint Inspection.

Evaluation Procedures to Determine the Presence of World Trade Center (WTC)-Related Dust and Debris in Residential Ventilation Systems in Lower Manhattan

1.0 SCOPE

The procedures contained in this document provide guidance for determining the presence of WTC-related dust in residential ventilation systems in Lower Manhattan. This document is solely concerned with determination of the presence of WTC-related dust in residential ventilation systems. Determining the exact nature of all hazardous air contaminants and contaminants other than airborne dust that may have been released during the WTC collapse and that may have potentially impacted ventilation systems operating at the time of the collapse is beyond the scope of this document.

This document provides general guidance to address the following with respect to residential ventilation systems impacted by WTC-related dust:

- Professional, health and Safety Requirements for Individuals performing the evaluations
- Evaluation Procedures (Visual Assessment, Historical Assessment, and Sampling Procedures)
- Post-Cleaning Visual Inspection Procedures

This document is limited in scope to evaluation of environmental conditions within the ventilation systems to determine whether they have been impacted by the WTC collapse. This document is not concerned with the following:

- The propriety of mechanical operation of the systems
- Environmental conditions, contaminants, or other conditions within the systems that are not related to the WTC collapse
- Recommendations and procedures that by their nature must be contaminant-specific

2.0 PURPOSE

The purpose of this document is to provide procedures for inspecting and evaluating residential ventilation systems in Lower Manhattan to determine if such systems have been impacted by airborne dust from the WTC collapse, and to provide guidelines for the qualifications of personnel accomplishing such inspection and evaluation.

WTC-related dust is generally considered to have common, consistent, and readily observable characteristics visually and tactilely differentiating it from common dust. WTC-related dust generally contains extremely fine particles similar in consistency to talcum powder, is light-colored, contains pulverized concrete and/or gypsum wallboard, and may contain asbestos fibers.

Ventilation systems are reservoirs for environmental dust and dirt. Therefore, in some cases, it may not be possible to visually differentiate between WTC-related dust and environmental dust that was present in the ventilation system prior to or after the WTC collapse.

3.0 APPLICABLE DOCUMENTS

This section provides full bibliography for references made within this document. Evaluations should be conducted in a manner that is fully compliant with the guidance provided in the following documents, to the extent applicable.

ACR 2002, *Assessment, Cleaning and Restoration of HVAC Systems*, National Air Duct Cleaning Association, Washington, D.C. (2002).

Section 3 of ACR 2002 includes procedures for performing a visual assessment of HVAC systems required in item 6.5.2.1 of this document.

NADCA Standard 97-05, *Requirements for the Installation of Service Openings in HVAC Systems,* National Air Duct Cleaning Association, Washington, D.C. (1997).

NADCA 97-05 includes procedures for installing service openings in HVAC systems and construction and material specifications for replacement panels, plates or access doors to cover such openings as required under item 6.5.1.2 of this document.

SMACNA HVAC Duct Construction Standards – Metal and Flexible, Sheet Metal and Air Conditioning Contractors' National Association, Inc., 2nd Edition (1995).

The SMACNA standard includes construction and material specifications for access doors for covering service openings as required under item 6.5.1.2 of this document.

SMACNA Fibrous Glass Duct Construction Standards, Sheet Metal and Air Conditioning Contractors' National Association, Inc., 6th Edition (1992).

The SMACNA standard includes construction and material specifications for access doors for covering service openings as required under item 6.5.1.2 of this document.

NFPA Standards 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* and 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems,* National Fire Protection Association (1999 Edition).

The NFPA standards include construction and material specifications for replacement coverings on service openings as required under item 6.5.1.2 of this document.

OSHA Regulations 29 CFR 1910, Occupational Health and Safety Standards

The OSHA regulations specify health and safety requirements for protecting employees during the inspection procedures.

4.0 PROFESSIONAL, HEALTH AND SAFETY REQUIREMENTS FOR INDIVIDUALS PERFORMING THE EVALUATIONS.

Many older ventilation system components contain both friable and nonfriable asbestos and may contain various contaminants such as mercury, PCBs, lead and microbial contamination. Aside from these contaminants, asbestos-containing pipe insulation, plaster and other asbestos-containing building materials may be disturbed during evaluation of ventilation equipment. Safety hazards such as fall hazards, electrical hazards, and mechanical hazards also may be encountered during evaluation of ventilation equipment. Due to the potential presence of these health and safety hazards, this section specifies minimum professional requirements for individuals performing the evaluations, as well as health and safety requirements pertinent to conducting the evaluations. It is not the intention of this document to provide all applicable health and safety requirements. It is expected that the entities performing work are knowledgeable in all federal, state and local health and safety requirements and standards pertinent to conducting the evaluations. This document references several key OSHA standards relevant to this work.

5.1 Evaluation Team

All evaluations shall be performed in teams consisting of a qualified HVAC/Electrical Professional and a qualified Environmental Professional. For large central air systems, it may be helpful to supplement the team with a Sheet Metal Professional.

5.2 HVAC/Electrical Professional - Requirements.

1. The HVAC/Electrical Professional shall be an employee of a professional, licensed mechanical ventilation contracting or engineering firm.

2. The HVAC/Electrical Professional shall be able to demonstrate competency and document experience in the following areas: air handling equipment identification and access, identification of system components, and installation of service openings in sheet metal and fibrous glass ducts in accordance with NFPA, NADCA and SMACNA guidelines and NYC building codes.

3. The HVAC/Electrical Professional shall have received training from their employer for reasonably anticipated hazards during HVAC work including training required under OSHA standards, including but not limited to lockout/tagout, fall protection, and personal protective equipment standards.

NOTE: If necessary, a licensed electrician shall be subcontracted to de-energize electrically operated equipment in accordance with OSHA's lockout/tagout requirements.

4. The minimum personal protective equipment required for use by the HVAC/Electrical Professional includes:

    a. a supply of disposable protective coveralls
    b. a supply of disposable protective gloves
    c. safety glasses
    d. respiratory protection as specified in item 4 below

5. The HVAC/Electrical Professional shall be capable of wearing and shall be provided with a P100 air purifying respirator with appropriate medical determination, fit testing and training as required under OSHA's personal protective equipment standard.

6. The HVAC/Electrical Professional shall have received 2-hour asbestos awareness training.

7. The HVAC/Electrical Professional shall be responsible for:

    a. the lockout/tagout of electrical or mechanical hazards required to safely perform the evaluations;
    b. the HVAC/Electrical Professional's firm shall provide sound equipment as needed to meet OSHA's fall protection requirements that may be applicable to parts of the evaluations and the HVAC/Electrical Professional shall be responsible for implementing the use of such equipment;
    c. locating and identifying ventilation system components to be included in the evaluation;
    d. any disassembly of any ventilation equipment and components required to complete the evaluation, and proper re-assembly following the evaluation; and
    e. assist the Environmental Professional in making determinations required in Item 6.4.

5.3 Sheet Metal Professional – Requirements

Requirements for the Sheet Metal Professional, if part of the evaluation team, are identical to those listed in item 5.2 for the HVAC/Electrical Professional.

5.4 Environmental Professional - Requirements

The Environmental Professional shall hold a current EPA accreditation as an AHERA Building Inspector. The primary purpose of the asbestos certification requirement is to be able to identify

asbestos-containing materials and asbestos-related hazards in order to avoid the disturbance of asbestos-containing materials during the evaluations.

1. The Environmental Professional shall have current EPA accreditation as an AHERA Building Inspector in any U.S. state.

2. The minimum personal protective equipment required for use by the Environmental Professional includes:

    a. a supply of disposable protective coveralls
    b. a supply of disposable protective gloves
    c. safety glasses
    d. respiratory protection as specified in item 3 below

    The Environmental Professional shall be capable of wearing and shall be provided with a P100 air purifying respirator with appropriate medical determination, fit testing and training as required under OSHA's personal protective equipment standard.

    The Environmental Professional is responsible for:

    a. ensuring that no asbestos-containing materials are disturbed during the evaluations;
    b. determining which personal protective equipment will be used by the HVAC/Electrical Professional, the Sheet Metal Professional and by the Environmental Professional during the evaluation; and
    c. collecting any bulk, wipe, microvac or tape-lift samples that are necessary to complete the evaluation;
    d. making determinations required in Item 6.3; and
    e. cleaning up any debris that may be disturbed as a result of the evaluation using a HEPA vacuum.

6.0 EVALUATION PROCEDURES

6.1 General

Ventilation systems are likely to vary widely in type, configuration and complexity. This evaluation procedure applies considers three general categories of ventilation systems that may be encountered in residential buildings in lower Manhattan:

1. Ventilators, wall air conditioning units and window air conditioning units **in common spaces**;

2. Fan coil or heat pump units **in common spaces**; and

3. Central systems with heating and/or cooling capabilities.

Wall air conditioning units and window air conditioning units which serve an individual residence are not included in this evaluation procedure. These units will be cleaned during the cleaning of residential spaces.

Note that exhaust systems such as bathroom and kitchen exhaust fans that directly remove room air to the outdoors are not included in this evaluation procedure. Components of direct exhaust systems typically include exhaust grilles, exhaust duct, exhaust fan, and rooftop or wall exhaust outlet devices. If information suggests that contamination of direct exhaust systems may be present, an evaluation may be performed using the same principles outlined for items 1, 2, and 3 above. Similarly, any ventilation equipment encountered that does not fall into any of these categories can be inspected using principles outlined in this section.

The locations within the ventilation system equipment expected to have the greatest impact from WTC-related dust include air intakes and intake ducts, intake air dampers, intake air filters and various system components located downstream of the intake air filters, depending on the system's filtration efficiency. Dust may collect at potential impingement points such as duct terminations, transitions and elbows, and interior system components such as control devices, dampers, thermal coils, turning vanes, fans, etc.

One factor that may be considered in performing the evaluation is whether or not the ventilation equipment operated during the WTC collapse and in the weeks immediately following the collapse. Equipment that was not operating due to power loss, or due to concerns about entrained dust may not have been impacted as heavily as equipment that operated throughout the collapse and immediate clean-up response.

Item 6.3 includes a listed of recommended equipment for performing the evaluation.

Item 6.4 includes a list of system components for each equipment category.

Item 6.5 includes the evaluation procedures that may be applied to each system component.

6.2 Documentation of Existing Mechanical Conditions

Prior to the start of the evaluation, the HVAC/Electrical Professional shall ensure that the ventilation system is cycled and that there are no obvious existing deficiencies affecting proper mechanical operation of the system for which the evaluation team may later be held responsible.

6.3 Recommended Supplies and Equipment

- Personal protective equipment (see 5.0)
- Sampling supplies (see 6.5.2.3)
- Disposal bags (see 6.5.2.3)
- Spray bottle containing soapy water

- Cleaning cloths
- Ladders (as needed)
- Lifts or scaffolding (as needed)
- Extension cords
- Hand tools (screw driver, pliers, etc.)
- Rotary metal cutting saw
- For covering service openings, sheet metal plates, panels or access doors meeting NADCA 9705, NFPA 90A/90B and SMACNA specifications
- Telescoping inspection mirrors and flashlights
- Boroscope
- HEPA vacuum

6.4 Typical system components for each equipment category

The ventilation systems may contain, but may not necessarily be limited to combinations of the listed components in each category.

6.4.1 Ventilators, wall air conditioning units and window air conditioning units in common spaces

- Outside air intake louvers, grates and screens
- Outside air duct
- Outside air dampers
- Return air grille
- Return air plenum
- Filter rack
- Filter media
- Coils (evaporator)
- Blower assembly
- Condensate drain pan
- In-line electrical resistance strip heaters (in supply ducts connected to unit ventilators)
- Fire dampers
- Turning vanes
- Supply plenum or supply duct liner
- Supply air diffuser

6.4.2 Fan coil/heat pump units in common spaces

- Return grille
- Return air plenum
- Filter rack
- Filter media
- Blower assembly

- Thermal coils
- Supply plenum
- Supply diffusers

6.4.3 Central air system

- Outside air intake louvers, grates and screens
- Outside air duct
- Outside air dampers
- Return air grilles
- Return air plenum
- Return air plenum damper
- Return air ducts
- Turning vanes
- Mixing chambers
- Filter rack
- Filter banks/media
- Pre-heat coils
- Cooling coils
- Re-heat coils
- Humidification and/or air cleaning equipment
- Fire dampers
- In-line re-heat coils
- Interior insulation
- Duct connectors
- Blower assembly including blower wheel, blower housing, air vanes, in-line noise attenuators, acoustical treatments (e.g., baffles, duct linings)
- Condensate drain pan
- Condensate accumulator
- Supply air plenum
- Supply air plenum damper
- Supply plenum or supply duct linings
- Supply air ducts (high and low pressure)
- Supply air diffusers
- Terminal boxes
- Open or ducted passive ventilation shafts

6.5 Evaluation Procedures

6.5.1 Accessibility

6.5.1.1 Locate System Components Accessible for Visual Inspection

The HVAC/Electrical Professional shall make an assessment of the accessibility of the various components of the system. For example, components may be enclosed within permanent sheet metal panels, or may be located above or behind solid plaster ceilings and walls.

Determine the components that are accessible. At minimum, representative surfaces of the following system components should be inspected:

- air intake (outdoor or return)
- air intake dampers
- return air grilles
- return air plenum
  - horizontal surfaces
  - impingement points (e.g. turning vanes, elbows, transitions)
- filter racks and filter media
- blower
- thermal coils
- interior surfaces of the supply air ducts
  - horizontal surfaces
  - impingement points (e.g. turning vanes, elbows, transitions)
- volume dampers
- terminal boxes
- supply diffusers

Note that depending on the size and complexity of the HVAC system, access may require the use of ladders, lifts or scaffolds using appropriate methods of fall protection.

6.5.1.2 Methods of Access

The following list summarizes methods of accessing HVAC system components for inspection:

- through existing service openings (i.e., access doors and panels)
- by disassembly of housing
- by installation of service openings (may range from 1” diameter holes to access doors)

The HVAC/Electrical Professional shall assess the accessibility of each HVAC system component to be inspected. If an HVAC system component is not accessible, the Environmental Professional shall be consulted to determine whether installation of a service opening will likely disturb asbestos-containing materials. After such consultation, if approved by the Environmental Professional, the HVAC/Electrical Professional shall install service openings as needed to inspect the HVAC components listed in 6.5.1.1.

NOTE: Disassembly of housing and installation of service openings may only be performed by the HVAC/Electrical Professional and replacement plates, panels or access doors shall be installed in accordance with NFPA, NADCA and SMACNA standards and NYC building codes.

The Environmental Professional shall repair or seal any interior/exterior duct insulation disturbed by the installation of service openings.

6.5.2 Methods of Evaluation

6.5.2.1 Visual Inspection Procedure

The HVAC/Electrical Professional and the Environmental Professional should jointly perform the visual inspection. At minimum, the components listed in 6.5.1.1 shall be inspected.

The visual inspection shall be accomplished using one or more of the following methods:

- direct examination
- telescoping inspection mirrors and flashlights inserted through service openings
- boroscopes inserted through supply air diffusers or other existing openings
- remotely operated video camera

6.5.2.2 Assessment of Conditions

Visual Assessment

All required interior surfaces in contact with the air stream shall be inspected for visible accumulations of dust and/or debris. Inspect all surfaces in contact with the air stream. Information indicates that some of the defining characteristics of WTC-related dust are that it contains extremely fine particles similar to talcum powder in consistency, is light-colored, contains pulverized concrete and/or gypsum wallboard, and may contain asbestos fibers. The visual inspection shall document:

- A general description of the appearance of interior surfaces of the various system components. The description for each component will include, but may not be limited to:

  - interior duct/fan housing surfaces are porous/non-porous
  - interior duct and fan housing surfaces are lined with insulation
  - interior duct and fan housing surfaces are double-walled (i.e. interior insulation with perforated metal cover)
  - filter loading, condition of filters and filter rack
  - interior surfaces are free/not free of visible dust and debris or suspect WTC-related dust and debris

- description of dust color, level of dust loading that may include:
  - the depth of dust observed on each component (e.g., less than 1/16 inch, greater than or equal to 1/16 inch.).
  - the depth and location of dust on ducts and fan housing (i.e., on interior bottom, top and sides of ducts)
  - visually estimated percentage of surface area with suspect WTC-related dust
- whether or not there are materials that are likely not associated with WTC-related dust such as building-related asbestos-containing materials, animal carcasses, delaminating lining material, visible mold growth, water damage, fecal matter, feathers or other evidence of animals, etc.

Historical Assessment

The evaluation team shall attempt to describe any other available information from site occupants or building managers, such as the known status of system operating conditions at the time of the WTC collapse, ventilation system maintenance (i.e., cleanings, filter changes, or replacement since the WTC collapse).

Based on these assessments, to the best of his/her ability the Environmental Professional will state a general impression of the overall cleanliness of each component, and whether or not it appears to be impacted by WTC-related dust.

7.0 Post-cleaning Visual Inspection

If cleaning occurs at the direction of EPA cleanliness verification shall be performed by the evaluation team consisting of a HVAC/Electrical Professional and an Environmental Professional as described in section 5.0 of this document after cleaning of one or more ventilation system components has been completed.

Following cleaning, the Environmental Professional shall ensure that all interior ventilation system components that were subject to the cleaning procedures are visibly clean. An interior surface will be considered visibly clean when it is free from non-adhered substances and debris.

To determine whether a surface if visibly clean, a thorough and comprehensive visual inspection and assessment of all cleaned components shall be performed in accordance with visual procedures established in items 6.5.2.1 and 6.5.2.2 of this document. In order to observe locations that are difficult to clean, additional access openings shall be installed as needed to conduct a comprehensive post-cleaning visual inspection.